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ABSTRACT

This paper looks into the question of the relationship between language and thought, and in particular, various theories advanced by Soviet psychologists. These theories are to be viewed within the context of the Soviet ideological legacy which proclaims that ideas do not exist apart from language. The current Soviet position can be summarized as follows. Language and its covert form, inner speech, evolve into an exact medium that can be effectively used in generalization, abstraction, and problem solving. The fact that the amount of private speech elicited increases with task difficulty attests to this relationship. Language serves a directive function in cognitive tasks. It evolves from being an interpsychological phenomenon to functioning as an intra-psychological phenomenon (Wertsch, 1977). Initially, speech and action are bound together; only gradually does the former direct the latter towards a goal. (Author/AM)

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Some Cognitive Implications of Language

Anthony D. Pellegrini

The relationship between language and thought has perplexed psychologists, linguists and philosophers for generations. (I would like to thank Dr. J. S. De Stefano, of Ohio State University, and Dr. James Wertsch, of Northwestern University, for the valuable feedback they provided in the course of my writing this paper.) One school of thought believes that a language's lexicon or syntax shapes the speaker's cognitive structures. An opposing view states that language merely reflects one's cognitive makeup. Soviet psychologists believe a strong connection exists between language and thought. Vygotsky saw the evolution of word meaning for the child as an indication of this relationship; as the child matures a word will acquire more and more meanings. More recent Soviet psychologists, unlike the verbal mediation theorists, stress the neurological relationship between language and thought. Where the verbal mediationists stress the symbolic importance of the word, the Soviet interpretation has the word, in the form of a neurological charge, stimulating the part of the cortex that relates to the semantic meaning of the word. To fully understand the current Soviet position, it will first be necessary to examine some of the ideological constraints inherent in it.

The importance assigned to language by Soviet psychologists may be the result of an ideological legacy left by Marx, Engels and Lenin. These men believed that "Ideas do not exist apart from language" (Sokolov, 1961, p. 669) i.e., thought and language are not one, but the former is expressed through the latter. This being the case, man can free himself from his immediate environmental constraints. (Slobin, 1966)

A second tenet of Soviet psychology, advanced by I. M. Sechenov, founder of Russian physiology (Leontiev and Luria, 1968), is that man's psychological development follows an evolutionary course. This stand coinsides nicely with Marx's theory of dialectical materialism, e.g., man's consciousness is the product of his interaction with history. This view states that the structure of one's mental processes are initially directed towards a goal by external forces, gradually becoming internalized to form cognitive structures.

Pavlov (Slobin, 1966) saw language as having an important role in man's cognitive development. According to Pavlov, humans receive two types of stimuli, first and second signals. First signals, perceived also by animals,

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are the physical stimuli provided by the environment. Second signals, unique to men, are words, with the primary function of abstraction and generalization of stimuli, which in turn, effect the functioning of the first signal system (Sokolov, 1961). Pavlov (Wilder, 1975-6) states that the second signal system provides kinethetic stimulation, originating in the speech organs and travelling into the cortex of the brain; speech signals act as feedback impulses. This position too, has its roots in the theory of Sechenov: "Thought ... is mediated through words and whispers, surely through movements of tongue and lips." (Slobin, 1966, pp. 140-1) Pavlov included auditory stimulation as a component of kinethetic feedback. Both systems transfer the signals from the stimuli perceived in the environment into the cortex. An association in the cortex between two stimuli is formed when the "two nervous centers are connected, (and) the nervous processes move from one direction to the other." (Zankov, 1957, p. 153) These connections remain in the cortex even after the stimulus was subsided. Objects and their properties can be impressed in the cortex only if they can be separated from their surroundings by means of the analyzer mechanism; "analysis is furnished by the peripheral endings (terminations) of all the afferent conducting nerves of the organism, each of which is specially adapted to transform a definite kind of energy" (p. 155). When an object is perceived, excitation is conducted along those nerves that make up the nerve center. This is where the trace of excitation is formed and retained. The second signal system is effective as a direct result of kinesthetic and aural stimulation, as well as their respective traces. (Zankov, 1957)

Chuprikova (1972) states that the formation of conditioned neural connections is closely related to excitability at the cortical points to which the stimuli are addressed, i.e., the brain areas associated with a reinforcing stimulus are especially susceptible to excitability. As a response becomes more conditioned the stimulus threshold is lowered. In animal experiments, a rise in excitation at the participating points does not occur immediately. In human experiments, on the other hand, involving verbal instructions, excitation is recorded immediately after the instructions are given, sometimes before the actual signal stimulus is given. Thus, the effectiveness of verbal instructions, as evidenced by increased excitation at cortical points addressed by a neutral stimulus, gives the stimulus cue status. Verbal stimulation results in immediate irradiation of excitation in the areas involved. Luria (1957) argues that if a CS is replaced by a word, the verbal stimulus will be more effective and the subject will react with more

intensity. A system of connections conditioned with the aid of language will not fade until it is cancelled by another verbally conditioned connection.

According to Luiblinskaya (1957) a child's ability to use verbal stimuli is built upon the relationship between the first and second signal systems. By making simple connections between physical stimuli and the words used to describe them, the child is gradually able to master words as signals, "which generalize a whole group of similar stimuli by abstracting the essential common features" (p. 198). The more experience a child accrues, the more efficiently he will be able to make use of the second signal system to isolate and differentiate features of stimuli. Vygotsky (in Luria and Yudovich, 1971) also noted this phenomenon when he stated that "perception and memory acquire new features" (p. 27) under the influence of the word. In this way perceived stimuli become more intelligible. Luria and Yudovich (1971) report a case where one of two retarded twins was given verbal training, resulting in her being able to make more generalizations from stimuli she observed.

As a child accumulates experience in the uses of oral language, words tend to take on a wider semantic range. Vygotsky (1962), one of the first Soviet psychologists to attend to this phenomenon, opened the door to an area now known as "semantic conditioning" (Slobin, 1966, p. 114; Luria and Vinogradova, 1959). By definition, semantic conditioning examines the conditioned responses to the meaning of verbal stimuli, not to the utterances' phonetic qualities. Because different semantic aspects of a word may be stored in different parts of the cortex, the presentation of words

> provoked in the subject, not an isolated, clearly delimited reaction, but a definite system of connections, and indicate that this system of links is of a strictly selective nature (Luria and Vinogradova, 1959, p. 90).

The introduction of a new verbal stimulus results in a distinct vascular reaction, i.e., contraction of finger blood vessels and the dialation of blood vessels on the surface of the head. This initial reaction to a stimulus is known as an orienting response. If semantically similar words are presented, the orienting response will again be aroused (Luria and Vinogradova, 1959). An example: a subject is presented with the Russian word doktor (doctor), which brings about a similar CR as the word vrach

(physician) but not to the word diktor (announcer) which resembles the CS only phonetically, not semantically (p. 116). Such reactions are usually elicited from young children who react to the phonetic qualities of the word. In semantic conditioning then, we have three groups of stimuli: the nucleus of the semantic complex, e.g. those words directly related semantically to the CS; the periphery of the semantic system; neutral words, e.g. those words which did not evoke an orienting response (Luria and Vinogradova, 1959, p. 99).

Words are seen as selectively exciting cortical and vascular reactions. Tikhormirov (1975-76) has examined the directive role of children's speech and concluded that speech acts not so much as a system of selective connections "but as a means of creating an auxiliary afferent impulse" (p. 55). The failure of the normal child to direct his actions with speech, usually before four years of age is due "to as yet undeveloped proprioceptive signalization" (p. 55). When the system is mature, however, the word, because of its flexibility and immediate excitory properties, makes self-direction more controllable. Following the evolutionary line, Luria (1961) states that such control is transferred from an external agent to the child himself. The gradual internalization of verbal forms is a result of the adult-child interactionary process. In Luria's (1961) first stage of development, approximately 1 1/2 to 3 years, certain directed movements may be elicited from the child by an adult's verbal commands, e.g., clap hands. However, at this stage, an adult's command is ineffective in inhibiting an action already in progress. In this imitation-inhibition paradigm (Wozniak, In Press), instructions given to inhibit an on-going activity only result in the Stage 1 child intensifying his actions. In another experiment the Stage 1 child is instructed to squeeze a ball when he sees a light flash; he squeezes when he hears when you see a light. He often squeezes continuously, even after the light has gone out. Inhibition of an on-going process was attained only when a movement was subordinated to a non-verbal inhibition task: When you see the light squeeze the ball and then touch your knee. The second instruction is inhibiting more squeezing because a new movement is initiated. Also in Stage 1, the child was told to Press the balloon at the flash and thereby put out the light (Wozniak, in press, p. 19). In this case, any inhibition that result is caused by what the Soviets call feedback, the exteroceptive signal provided by the light going out.

The second stage, approximately 3 to 4 1/2 years is marked by the child's own external speech acting as the

inhibiting agent. The child is now capable of using adult instructions before a task begins because he does not respond immediately to the stimulus provided by the verbal instructions. He can wait for the signal before responding, but he still cannot inhibit an on-going response. When a child was told to say go when a light flashed and then squeeze, all excitory squeezing was successfully inhibited. The inhibitory effect of the child's speech in this case resulted from the utterances motor component, not its semantic component.

In the double-discrete-vocalization paradigm (Wozniak, In Press), the child successfully squeezed the balloon twice when instructed to say go, go but did not respond correctly when told to say I shall press twice. In the discrimination vocalization paradigm, the child is instructed to say press and press to a positive signal and to say don't press and refrain from pressing to a negative signal. The Stage 2 child responds correctly verbally to both types of stimuli but the discriminative motor responses break down. Press leads to a "concentration of excitation and produced distinct motor reactions coordinated with the signal" (p. 8). Don't press led to the disinhibition of the motor response which was stimulated by the verbal impulse. When children were told not to respond verbally to the negative signal and refrain from pressing only 42% of the responses were impulsive, compared to 70% when S's said don't press.

The success in the press condition can be explained by the excitation provided by the verbal stimulus's motor component which irradiated to a motor response. The don't press condition was not successful for the same reason, the child was responding to the motoric aspect of the utterance. Wozniak (In Press) speculates that the failure of the don't press condition may lie in Pavlov's inhibition of inhibition phenomenon, i.e., if one has a conditioned response, the idea, don't press, and if another agent, the utterance, don't press, is added, the latter will inhibit the former.

Stage 3 is characterized

> by the transfer of the regulation function of speech from the impulsive side....to the analytical system of elective connections which are produced by speech (and by the simultaneous shift) from the external to the internal speech of the child (Wozniak, In Press, p. 10).

Language as a means of directing behavior becomes more internalized as the child matures. Internalized speech or private speech, like overt speech, has a kinesthetic component. Sokolov (in Slobin, 1966) states:

> Generally active forms of thinking, connected with the need for a more or less prolonged and developed deliberation, are always accompanied by a strengthening of the speech kinesthesae, whereas repeated thought actions are accompanied by their reduction (p. 141).

The phasic, or external, side of speech diminishes in favor of inner speech. Private speech, according to Sokolov (1961), if exhibited in problem solving situations includes auditory, visual and kinesthetic components. Articulation of words to oneself, though not visible to the observer, are usually accomplished by muscular movement in the speech apparatus, thus transmitting kinesthesae to the cortex (Tsvetkova and Shaji, 1970).

Electromyograms (EMG) are used by both Soviet and Western psychologists to record muscle flexes in the speech organs. Sokolov (1967) states that EMG scores may vary with: the difficulty or novelty of a task, the degree of automazation used in solving the problem, the inclusion of graphic images used in solving the problem, and individual preferences for a given strategy. The most active bursts are associated with orienting responses. Luria (1957) reports that EMG's decline as the problem at hand is mastered, and becomes more overt if difficulty is encountered. Sokolov (1961) states that the EMG level when one repeatedly counts the same numbers is lower than when one is asked to count the exact numbers in reverse. Edfeldt (1960) found his subjects had higher EMG's as they were learning to read, while good readers record very low scores, except when they encounter difficulty. Novikova (in Sokolov, 1961) found that tasks of varying degrees of difficulty ellicited different amounts of speech kinesthesae; for the easiest problems 70% of the subjects generated speech kinesthesae, 80% for more difficult tasks, and 90% on the most difficult problems.

Wozniak (In Press) reviewed attempts made by Western psychologists to duplicate Luria's results and concludes that the main reason for the overwhelming failure of these attempts is due to misinterpretation of the Soviet stand. Jarvis (in Slobin, 1966) warns that reduplication of the

results fails because of the inadequacies of Soviet experimental design:

> I would suggest...that you ask yourself what kind of experimental designs seem to have been used, what experimental variables have been left uncontrolled, what subjects have been ignored (p. 133).

In conclusion, we can state that thought and language are not one and the same but are indeed closely related. Language and its covert form, inner speech, evolve into an exact medium that can be effectively used in generalization abstraction, and problem solving. The fact that the amount of private speech elicited increases with task difficulty attests to this relationship. Language serves a directive function in cognitive tasks. It evolves from being an interpsychological phenomenon to functioning as an intra psychological phenomenon (Wertsch, 1977). Initially speech and action are bound together, only gradually does the former direct the latter towards a goal.

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